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ABSTRACT

Paul Hanna (1966), in his classic spelling study, developed frequency tables that described the relative frequency of the letters (graphemes) used to represent the major English sounds (phonemes). By restructuring the Hanna tables, a set of tables may be developed for estimating levels of reading difficulty based upon the relative frequency of the grapheme-phoneme correspondence. The tables were restructured by listing the graphemes as the discriminating stimulus and then listing their corresponding phonemes in order of relative frequency of occurrence in the English language; this creates tables responsive to the decoding process involved in reading rather than to the encoding process reflected in the Hanna tables. The new tables were then used to evaluate the decoding difficulty of the words listed in the Hanna study. Evaluating words in this way allows words with frequently occurring grapheme-phoneme correspondences to be chosen in developing instructional materials. This allows students to acquire basic skill in decoding before learning the many exceptions found in symbol/sound relationships in English. Tables are included of phoneme percentages for vowel graphemes and for consonant graphemes. (AA)

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THE GRAPHEME-PHONEME PROBLEM IN READING

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The classic Hanna (1966) study was devoted to the encoding process in spelling, based on relative phoneme-grapheme choice. In the study, Hanna developed frequency tables that described the relative frequency of the letters (graphemes) used to represent the major English phonemes (sounds). This process is represented when the student internally vocalizes a word and then selects graphemes based upon the corresponding internal phoneme. But there are many ways to spell a sound. For example, if the child is saying "ate", or "eight" mentally, the phoneme structure is the same, but the encoding process involves the correct selection of graphemes. So, the "spelling problems" begin.

The cognitive mediation process in reading is exactly the opposite. In reading, the student attends to the grapheme and produces a phoneme. This is decoding even though the student is producing a vocal or sub-vocal evidence of the event. He or she is not encoding because they are not producing a message but decoding and giving evidence of the interpretation of the message.

METHOD

Relative frequency is still the critical element in research concerning decoding, as it was in encoding.

By restructuring the Hanna Tables, a set of tables may be developed to be used in estimating levels of reading difficulty

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based upon the relative frequency of the grapheme-phoneme correspondence. For example, when students see the printed letter "a" in a word, they have three high frequency choices, "a" as in cat, "a" as in about, or "a" as in mate, to which one may respond phonemically.

The restructuring of the Hanna tables was accomplished by listing the graphemes as the discrimitive stimulus and then listing their alternative corresponding phonemes in order of relative frequency of occurrence in the English language. This procedure was necessary to create tables responsive to the decoding process rather than to the encoding process as found in the Hanna tables. Once the grapheme phoneme relationships were established (a reversal of Hanna's process), the Hanna tables were used to obtain relative frequency classifications for each symbol sound combination.

The new tables (grapheme to phoneme rather than phoneme to grapheme relative frequency occurrences) were then used to classify the words listed in the Hanna study based on decoding difficulty established by relative frequency occurrences of the symbol-sound relationships. Webster's Seventh New Collegiate Dictionary was used as the resource for establishing the phonetic structure of each word. The word list resulted in twleve distinctive categories, operationally defined as filter levels, that are useful in selecting words for reading instruction or instructional material development. Using words with high frequency grapheme-phoneme relative frequency occurrences allows the student to acquire a basic working skill in decoding before learning the many exceptions found in symbol-sound relationships in the English language. With the more common phonemic alternatives located,

the teaching implications are then immediate. For example, we would instruct the student that the grapheme "a" has three common sounds and suggest that where the context doesn't solve the problem, each sound should be tried in order. The order, based on relative frequency occurrences, is to first try short "a", second try schwa "a", and third try long "a". All the other phonemes that may be produced less frequently from the grapheme "a" may be taught as special applications of symbol-sound relationships. The student has no cues except contextual, therefore, the recalculation must be given the relative frequency of grapheme-phoneme in relation to the total sound spectra. With this data available, the task of the developer of reading material is to provide words based on the more frequent phonemes as related to the printed graphemes.

Writers who want to produce reading materials of varying expected difficulty can use Tables 1 and 2 as reference for selecting the desired grapheme-phoneme relationships:

TABLE 1

PHONEME PERCENTAGE TABULATIONS FOR VOWEL GRAPHEMES OCCURRING IN AMERICAN ENGLISH: 22 VOWEL CLASSIFICATION*

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
A	/æ/	cat	.038
	/ə/ or schwa "a"	about	.013
	/e/	able	.009
	/a/	cart	.007
	/ɛ/	marry	.001

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
A-E (a-cued final silent e)	ā	date	.007
	ă	valve	.001
AI	ā	rain	.001
AU	ŏ	aught	.001
AY	ā	hay	.001
E	ĕ	bed	.030
	ē	even	.016
	ŭ or schwa "e"	harem	.007
EA	ē	bean	.002
	ĕ	weapon	.001
E-E	ĕ	absence	.001
EE	ē	tree	.002
ED	t	liked	.001
I	ĭ	hit	.049
	ŭ or schwa "i"	florid	.012
	ī	ice	.005
I-E (i-cued final silent e)	ī	kite	.005
	ĭ	since	.003
O	ŏ	not	.018
	ō	go	.017
	ŭ or schwa "o"	honey	.015
O-E	ō	tote	.003

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
OO	o͞o	hoot	.001
	o͝o	book	.001
OU	u͝ or schwa "o"	ought	.003
	ou	out	.002
OW	o͞	low	.001
	ow	allow	.001
U	u͝ or schwa "u"	full	.013
	u͞	uniform	.007
	o͝o	rule	.001
U-E	u͞	mule	.002
Y	i͝	pretty	.016
	i͞	sky	.001

*Only those occurrences greater than or equal to .001 are listed.

TABLE 2

PHONEME PERCENTAGE TABULATIONS FOR CONSONANT GRAPHEMES OCCURRING IN AMERICAN ENGLISH: 20 CONSONANT CLASSIFICATION*

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
B	b	bat	.020
C	k	cow	.031
	s	city	.009
CH	ch	church	.002
	k	ache	.001
CK	k	cheak	.002

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
D	d	dog	.033
F	f	for	.014
FF	f	different	.001
G	g	go	.010
	j	gin	.005
H	h	hit	.007
J	j	joy	.002
K	k	key	.005
L	l	lot	.045
LE	el	able	.005
LL	l	allude	.004
M	m	man	.030
MM	m	Tommy	.001
N	n	need	.068
	ng	punctuate	.002
NG	ng	sing	.003
NN	n	Bonnie	.001
P	p	pan	.030

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
PH	f	phone	.002
PP	p	topping	.001
QU	kw	quack	.001
R	r	rat	.083
AR**	rr	tar	.001
ER**	rr	her	.018
IR**	rr	sir	.001
OR**	rr	for	.002
UR**	rr	fur	.002
RR	r	carry	.001
S	s	self	.045
	z	rise	.005
SH	sh	show	.003
SS	s	kiss	.004
T	t	take	.069
	ch	actual	.001
TH	th(1)	thin	.003
	th(2)	that	.001
TI	sh	nation	.007
TT	t	attic	.001
V	v	valid	.013
W	w	west	.005
X	ks	Rex	.002

GRAPHEME	PHONEME	EXAMPLE	TOTAL PERCENTAGE
Z	z	zebra	.002

*Only those occurrences greater than or equal to .001 are listed.

**Included as a consonant r-e-cued grapheme producing the phoneme or "rr".

IMPLICATIONS

Past work in grading materials according to reading difficulty has been principally on sentence-length, and word frequency.

With the material available in this article, the "hidden" phonetic difficulty of word structure can now be controlled. Experimental work with graded reading materials based on this kind of selection has shown that reading material can be controlled for difficulty, Roberts (1973).[2] Of course, it is challenging to present some ideas within the constraints for simplified phonics. For example, in a story having to do with rain, it was necessary to talk about its being wet, since the "ai" for long "a" has a frequency too low to use at the easiest level, which is a single sound for each symbol.

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